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October 7, 2005

Mr. David Abelson
Rocky Flats Coalition of Local Governments
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Westminster, CO 80031

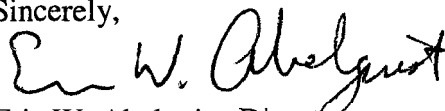
**SUBJECT: CONTRACT NO. DE-AC05-00OR22750
DRAFT — INDEPENDENT VERIFICATION OF SOILS
AT THE 903 PAD INNER AND OUTER LIP AREAS ROCKY FLATS
ENVIRONMENTAL TECHNOLOGY SITE GOLDEN, COLORADO**

Dear Mr. Abelson:

The Environmental Survey and Site Assessment Program (**ESSAP**) of the **Oak** Ridge Institute for Science and Education (ORISE) has prepared the subject draft report for your review. ORISE performed independent verification survey activities in the 903 Lip Area during the periods June 27 to 29, 2005 and September 20 to 22, 2005. Please provide any comments that you may have on this draft to me by October 14, 2005.

Please contact me at (865) 576-3740 or Scott Kirk at (865) 574-0685 should you need additional information.

Sincerely,



Eric W. Abelquist, Director
Environmental Survey
and Site Assessment Program

EWA:db

Enclosure

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**INDEPENDENT VERIFICATION OF SOILS
AT THE
903 PAD INNER AND OUTER LIP AREAS
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO**

INTRODUCTION AND SITE HISTORY

The Atomic Energy Commission, predecessor agency to the U.S. Department of Energy (DOE), selected the Rocky Flats site in 1951 to serve as a nuclear weapons component production facility. Production began in 1952 on both nuclear and non-nuclear components with the plutonium pits being the key component. Uranium and beryllium were also utilized in the production of various components and processes. Operations continued until 1989 when environmental and safety concerns temporarily halted operations. There were over 700 structures, such as process and support buildings, that were involved in the site's mission. In 1993, the production mission was permanently ended and a new mission to clean up the site by 2006 was initiated. The site has since been renamed **as** the Rocky Flats Environmental Technology Site (RFETS).

Kaiser-Hill Company, LLC (K-H), is the DOE contractor responsible for closure of the RFETS by the year 2006. Decontamination for the purpose of demolition and disposal has been completed by K-H for nearly all buildings that once used or stored plutonium. As the building decontamination and demolition nears completion, K-H will perform additional soils remediation and final surveys of the soils in the Buffer Zone and Industrial Area. The Rocky Flats Cleanup Agreement (RFCA), which was signed on July 19, 1996, and revised on May 28, 2003, is the governing agreement for the soils cleanup effort. RFCA superseded the earlier Interagency Agreement (IAG) and was a legally binding agreement between the DOE, the Environmental Protection Agency (EPA), and the Colorado Department of Public Health and Environment (CDPHE) to accomplish the required cleanup of **RFETS (K-H 2004)**.

Prepared by the Environmental Survey and Site Assessment **Program**, Radiological Safety, Assessments, and Training, Oak Ridge Institute for Science and Education, Oak Ridge, TN, under Contract No. DE-AC-05-00OR22750 with the U.S. Department of Energy.

Initial site characterization efforts at RFETS began in July 1986 under the RCRA/CERCLA Compliance Agreement and continued under the IAG as a result of events that included storage of leaky drums on the 903 Pad, a fire in Building 771 in 1957, and a fire in Building 776/777 in 1969. A comprehensive list of all known and suspected hazardous, radioactive, and mixed waste sources at the site has been compiled—360 release sites have been identified at RFETS (K-H 2004). These release sites, or Individual Hazardous Substance Sites (**MSS**), refer to specific locations where solid wastes, hazardous substances, pollutants, contaminants, hazardous wastes, or hazardous constituents may have been disposed of or released to the environment within the RFETS site at any time, irrespective of whether the location was intended for the management of these materials.

Environmental restoration activities have been ongoing for several years with remediation of the 903 Pad beginning in November 2002. This effort resulted in the removal of a 3.4-acre asphalt pad and the underlying plutonium contaminated soil. Borehole data indicated that radioactive contamination was generally contained in the top 30 cm of native soil—yet deeper excavations were necessary in some locations. Confirmation samples that were collected on 7.6-m (25-foot) grid centers showed that in many sectors, plutonium contamination greater than 50 pCi/g was present after excavating the upper **30** cm of native soil. Where this occurred, excavation of soils continued until the soils were confirmed to be below the RFCA action level of 50 pCi/g, or to a depth of 0.9 m (3 feet) of native soil. Cleanup of the surrounding areas included the americium zone and 903 Lip Area in 2003 and 2004. The 903 Pad and surrounding areas represented the largest concentration of plutonium-contaminated soils at Rocky Flats (EPA 2005).

The DOE's Rocky Flats Project Office (RFPO) requested that the Environmental Survey and Site Assessment Program (ESSAP) of the *Oak Ridge* Institute for Science and Education (ORISE) provide independent verification (IV) of the RFETS site. Furthermore, RFPO has requested that ORISE coordinate with the Rocky Flats Coalition of Local Governments (RFCLOG) and Rocky Flats Citizens Advisory Board (RFCAB) to incorporate their input into this project-specific plan prior to submitting to DOE for approval (DOE 2004).

SITE DESCRIPTION

The WETS is located approximately 16 miles northwest of Denver, Colorado on State Highway 93 and Cactus Road. The WETS Industrial Area occupies approximately 385 acres within the 6,400-acre DOE reservation site. The site has been divided into two major operable units, the Industrial Area and the Buffer Zone. All nuclear facilities at the site are within the boundaries of the Industrial Area. The Industrial Area contained more than 700 buildings at one time—several of them extensively contaminated with plutonium (Figure 1). The Buffer Zone surrounds the Industrial Area and protects the site from potential encroachment. Largely retained as open space, the Buffer Zone holds very few facilities, except for support facilities such as retention ponds, monitoring stations, sanitary landfills and dirt roads used for access and fire breaks.

INDEPENDENT VERIFICATION OBJECTIVES

The primary objective of the independent verification is to evaluate the K-H final survey plan (K-H 2005a), specifically assessing the 1) performance of the aerial and targeted ground-based scanning, 2) performance of K-H investigations of aerial and targeted ground-based scanning results, and 3) adequacy and completeness of K-H closeout reports in **MSS** areas that have not already been restored with a soil cover (e.g., 903 Lip Area).

The initial verification effort began with establishing the adequacy of the K-H closeout effort in the 903 Pad Lip Areas. This independent verification activity specifically assessed whether the compliance decision reached using the MARSSIM process in the 903 Lip Areas was consistent with that reached by the closure contractor and endorsed by the regulators using the approach specified under RFCA (K-H 2005b).

DOCUMENT REVIEW

The Independent Verification Team (IVT) has reviewed the closure contractor's procedures, final survey plan, and supporting data and documentation for the 903 Pad Lip Area (K-H 2005b). The review focused on the survey methodology and instrumentation detection capabilities and calibration to determine the adequacy and appropriateness of the closure contractor's approach relative to the data quality objectives (DQOs).

FIELD SAMPLING AND MEASUREMENT PROCEDURES

The N T approach is based on collecting independent data demonstrating that current radiological conditions satisfy the release criteria and meet the independent verification objectives listed above. ESSAP conducted independent verification surveys of the 903 Lip Area during the periods June 27 to 29, 2005 and September 20 to 22, 2005. The first survey effort in June 2005 was performed in accordance with MARSSIM and included gamma radiation scanning and systematic and judgmental soil sampling. The second survey effort conducted in September 2005 was a follow-up survey to determine the areal size of each of the elevated areas identified during the initial survey. The following sections describe the independent verification survey design for the 903 Lip Area.

MARSSIM Survey Design

The IVT selected two areas within the completed 903 Lip Area—one area each within the Inner Lip and Outer Lip—for the performance of final surveys according to the Multiagency Radiation Survey and Site Investigation Manual (**MARSSIM**) guidance (Figure 2). Each area selected was approximately 2,000 m² (consistent with a Class 1 survey unit in MARSSIM).

The IVT followed the process of designing a MARSSIM final survey, starting with the development of data quality objectives (DQOs). The Sign test was applied to determine the necessary soil sample size based on the cleanup criteria (referred to as derived concentration guideline levels (DCGLs)) and expected radiological conditions in each survey unit selected. Specifically, the N T used the radiological data reported in the 903 Lip Area closeout report (K-H 2005b) to obtain inputs for the sample size determination for each survey unit. The Type I (**α**) and Type II (**β**) decision errors were set at 0.05. The sample size was not increased to account for the actual scan MDC of the radiation detector used—this is a necessary deviation from the MARSSIM process because area factors have not been approved for WETS. Sample locations were determined on a random-start triangular grid pattern (NRC 2000).

The Inner Lip survey unit measured 45 m x 45 m (2,025 m²). Based on the mean and standard deviation (21.8 and 14.5 pCi/g Pu-239/240, respectively) in this area from the K-H report (K-H

2005c), the MARSSIM sample size based on a relative shift of 1.95 was 16 (Figure 3). The Outer Lip survey unit also measured 45 m x 45 m (2,025 m²). Based on the mean and standard deviation (22.5 and 15.2 pCi/g Pu-239/240, respectively) in the K-H report (K-H 2005b), the MARSSIM sample size based on a relative shift of 1.81 was also 16. Due to the random start location, the actual number of samples collected from this survey unit was 20 (Figure 4).

Elevated Area Bounding Survey Design

Several areas of elevated radiation were detected by scanning during implementation of the MARSSIM final survey in the 903 Lip Area survey units. Soil samples were collected from each of these areas and shipped to the ORISE radiochemistry laboratory in Oak Ridge, Tennessee for analysis. The results of these laboratory analyses confirmed the presence of Pu-239/240 at concentrations greater than 50 pCi/g within each survey unit.

Scanning, static measurements, and soil sampling were conducted during the second survey to estimate the areal size of each elevated area. Specifically, scans were performed in the vicinity of each elevated area previously identified. Static measurements with the same radiation detector were then performed at various distances and directions from the hot spot to map out the size and shape of the elevated area. A field action level of 500 counts per minute (cpm) on the detector, based on data collected from the first survey and subsequent soil analyses, was used as a correlation factor to the RFCA soil action level of 50 pCi/g. Additional soil samples were then collected within the estimated boundaries of each elevated area to further validate the size of the hot spot.

FIELD SURVEY PROCEDURES

Survey activities were performed in accordance with the ORISE/ESSAP Survey Procedures Manual and the Quality Assurance Manual (ORISE 2004 and 2005a).

Reference Grid

The **IVT** used a global positioning system (GPS) and survey unit reference system established by

the closure contractor to identify measurement and sampling locations. Measurement and sampling locations were documented on detailed survey maps.

Surface Scans

Surface scans for gamma radiation were performed over 100 percent of each of the two 45 m x 45 m survey units in the Inner and Outer Lip Areas during the initial survey. During the second survey, surface scans and static measurements were performed in the general vicinity of each identified elevated area. These data were used to map the size and shape of each elevated area.

Surface scans and static measurements were performed using sodium iodide (NaI) FIDLER scintillation detectors. Detectors used for scanning were coupled to ratemeter-scalers with audible indicators. Locations of elevated direct radiation identified during the initial survey were marked for further investigation.

Soil Sampling

Surface soil samples (0 to 15 cm deep) were collected for analysis by gamma spectroscopy. Systematic soil sample locations were determined in both survey units—16 samples in the Inner Lip, and 20 samples in the Outer Lip. Additionally, four samples from the Inner Lip and 10 samples from the Outer Lip were collected at judgmental sample locations based on elevated radiation levels identified by scanning.

During the second survey, additional soil samples were collected to bound the elevated areas identified initially. Twenty additional soil samples were collected for this purpose.

SAMPLE ANALYSIS AND DATA INTERPRETATION

Radiological samples and data were returned to the ORISE/ESSAP laboratory in *Oak Ridge*, Tennessee, for analysis and interpretation. Sample analyses were performed in accordance with the ORISE/ESSAP Laboratory Procedures Manual (ORISE 2005b). Soil samples were analyzed by gamma spectroscopy and reported in units of picocuries per **gram** (pCi/g). Each sample was

analyzed via gamma spectroscopy for Am-241, U-235, and U-238. The Pu-239/240 to Am-241 ratio of 5.7 developed by the closure contractor was used to obtain the Pu-239/240 concentrations. Once the sample data were analyzed, a data quality assessment (DQA) was performed according to MARSSIM guidance. The Sign test was used to evaluate the radionuclide concentrations in the selected survey units.

Radiological data were compared to the closure contractor's results and the established release criteria for RFETS. The RFCA action level for Pu-239/240 in soil is 50 pCi/g, with a provision for hot spots as indicated in the following table. The size and shape of each elevated area (greater than 50 pCi/g) was estimated as well.

The RFCA action levels for other radionuclides are based on a 1E-5 risk to a future wildlife refuge worker. It is understood that the RFCA action levels will be demonstrated for all of the potential contaminants in the Rocky Flats soils, including Pu-239//240, Am-241, U-234, U-235, and U-238. The **RFCA** action levels for each radionuclide are as follows (K-H 2005a):

Radionuclide	RFCA Action Level^a	Hot Spot Criteria^b
Am-241	76 pCi/g	228 pCi/g
Pu-239/240/240	50 pCi/g	150 pCi/g
U-234	300 pCi/g	900 pCi/g
U-235	8 pCi/g	24 pCi/g
U-238	351 pCi/g	1,053 pCi/g

^a Based on the K-H Final Survey Plan, the sum-of-ratios method is not applicable to the **RFCA** action levels for **this** final survey effort (K-H 2005a).

^b Based on the K-H **Final** Survey Plan, a hot spot is defined as an area no greater than 80 m² (K-H 2005a).

FINDINGS AND RESULTS

DOCUMENT REVIEW

The soil sampling and analysis procedures were considered to be appropriate and adequately documented in the 903 Lip Area Report (K-H 2005b). The methodology agreed to by K-H, DOE, EPA and CDPHE to demonstrate the adequacy of the remediation in the 903 Lip Area

required confirmatory soil samples to be taken after soil removal. However, the agreed upon methodology did not include 100% radiation scans of the 903 Lip Area after remediation, which would be necessary to identify small areas of elevated contamination levels. That is, scans were performed prior to remediation in the 903 Lip Area to identify the presence and location of contamination, but scanning was not performed after remediation to assess whether the remediation was complete.

SURFACE SCANS

Several areas of elevated gamma radiation were identified in both survey units. Three areas were identified in Inner Lip survey unit, while approximately ten were identified in the Outer Lip survey unit.

During the second survey, FIDLER scanning and static measurements were used to map each of the elevated areas. Figures 5 through 13 illustrate the estimated size and shape of each elevated area. Note that following the second survey, it was determined that several of the original 13 elevated areas were part of the same area, resulting in the 9 areas illustrated on Figures 5 through 13.

RADIONUCLIDE CONCENTRATION IN SOILS

Gamma spectra were reviewed for Am-241 at the 0.059 MeV peak to estimate the Pu-239/240 concentration. A multiplier of 5.7 was used for the conversion. Table 1 provides the radionuclide concentrations in soil from the MARSSIM systematic locations. All of the Pu-239/240 concentrations in both units were less than the RFCA action level of 50 pCi/g. Specially, Pu-239/240 concentrations ranged from 0.57 pCi/g to 29.7 pCi/g in the Inner Lip, and from 0.74 pCi/g to 42.0 pCi/g in the Outer Lip.

Table 2 provides the radionuclide concentrations in soil from the judgmental sample locations collected during the initial survey. The Pu-239/240 concentrations in these samples ranged from 65.4 pCi/g to 425 pCi/g.

Table 3 provides the radionuclide concentrations in soil for the sample locations selected to bound the size of each elevated area. The Pu-239/240 concentrations in these samples ranged from 7.13 to 295.3 pCi/g (only one sample was below the 50 pCi/g action level).

COMPARISON OF RESULTS WITH GUIDELINES

Results of the surveys were compared to the applicable guidelines. Specifically, a DQA was performed according to MARSSIM guidance. Given that all of Pu-239/240 concentrations from systematic sample locations were less than the RFCA action level, the Sign test was easily performed; both survey units passed the statistical test indicating that the average in the survey unit met the release criteria.

The judgmental sample results from both survey units exceeded the RFCA action level of 50 pCi/g, and in some cases exceeded the hot spot criterion of 150 pCi/g. A 100% scan of the 903 Lip Area by K-H would have been necessary to identify these relatively small areas of elevated contamination levels.

The areas of the hot spots as indicated on Figures 5 through 13 range from 0.8 to 35 m². The soil sample results provided in Table 3 serve to validate the size of these estimated hot spot areas. The MARSSIM provides guidance on how to assess the presence of hot spots through the use of area factors. That is, **MARSSIM** recommends that dose or risk modeling be used to establish area factors—the magnitude (factor) by which the residual radioactivity in a small area (hot spot) can exceed the average guideline (50 pCi/g) while maintaining compliance with the release criterion. Because area factors were not developed for this closure project, an assessment of how **MARSSIM** would handle these elevated areas is not possible. Once each individual elevated area is assessed using the area factor approach, **MARSSIM** further recommends an assessment of all the hot spots identified in the survey unit using Equation 8-2 in **MARSSIM** (NRC 2000).

Consistent with the **MARSSIM** approach to evaluate the dose or risk impact from hot spots, **ORISE** recommends that the effect on **risk** due to the identified elevated contamination levels be assessed to assure compliance with the RFCA release criteria (i.e., 1E-5 risk to a future wildlife

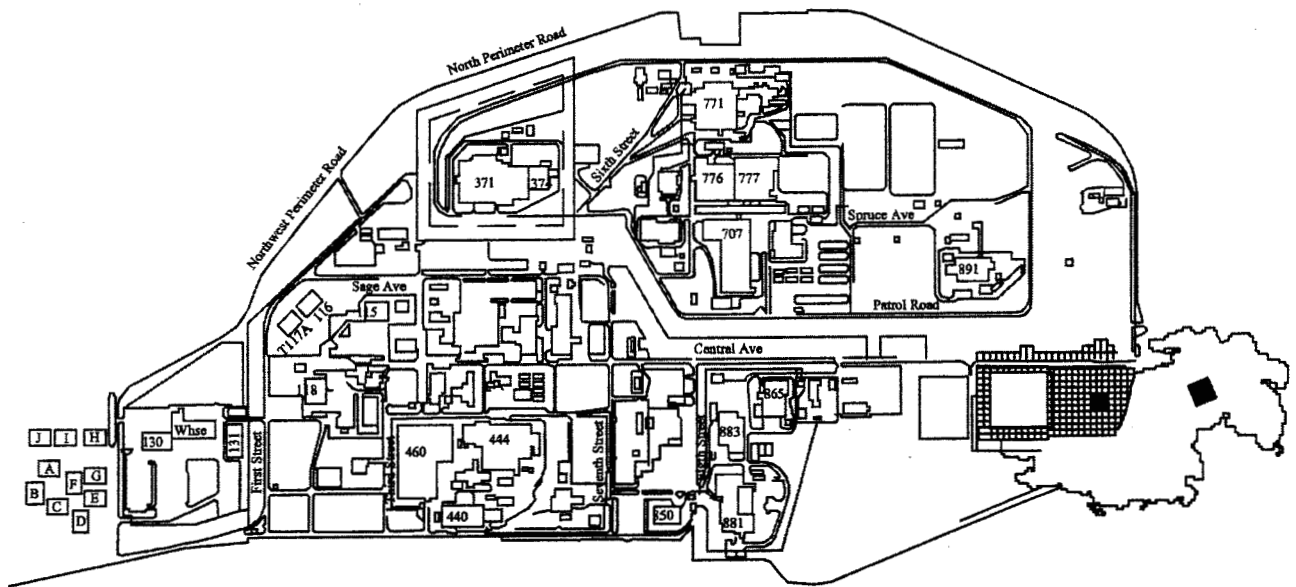
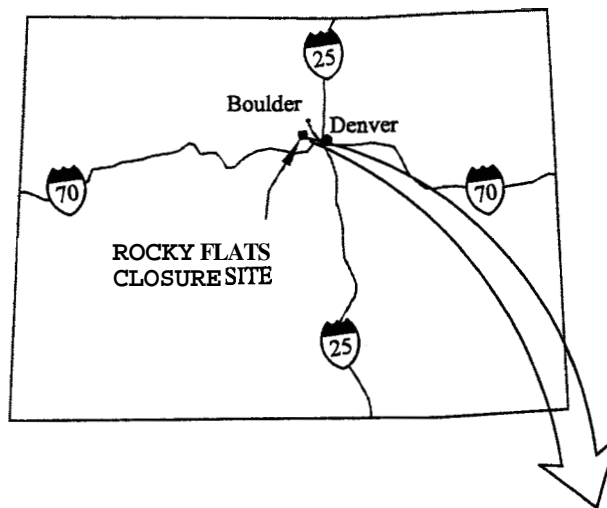
refuge worker). Similarly, this risk assessment should extend to other soil areas in the 903 Lip Area not surveyed by ORISE.

SUMMARY

During the periods June 27 through 29, 2005 and September 20 to 22, 2005, the Environmental Survey and Site Assessment Program of the Oak Ridge Institute for Science and Education (ORISE) performed an independent verification survey of the 903 Pad Inner and Outer Lip Areas. Survey activities consisted of gamma surface scans, static measurements and the collection of soil samples.

ESSAP's independent verification results in the 903 Lip Areas demonstrated that the average Pu-239/240 concentration satisfied the RFCA action level. A total of thirteen elevated areas were identified in the survey units (3 in the Inner Lip and 10 in the Outer Lip). Additional survey activities to estimate the size of the elevated areas resulted in a range of 0.8 to 35.3 m² for the individual areas with a total area of approximately 66 m² or 1.6% of the 4050 m² total survey area. It is ESSAP's conclusion that these results are likely representative of the 903 Lip Area as a whole.

FIGURES



NOT TO SCALE

FIGURE 1: Plot Plan Rocky Flats Site

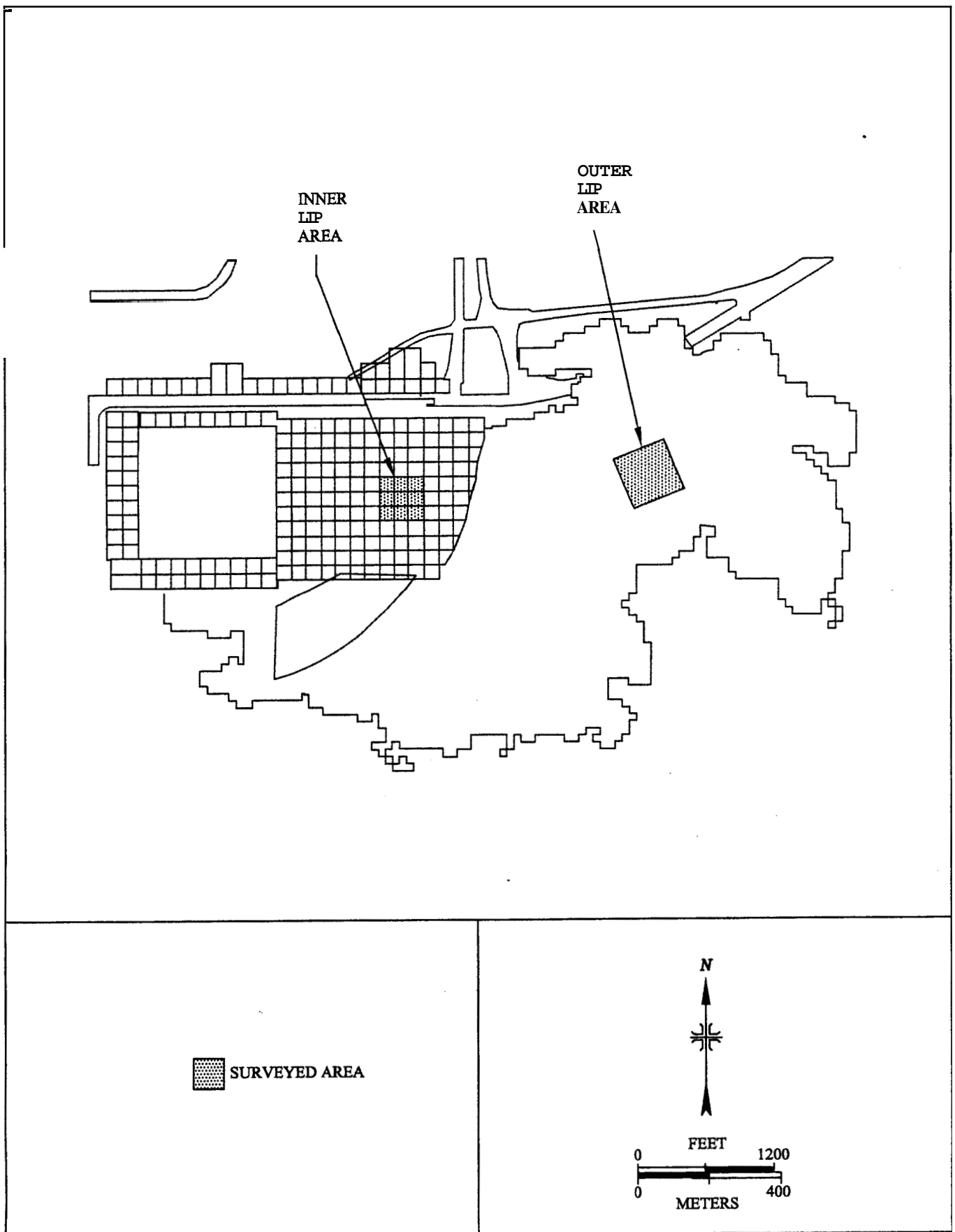
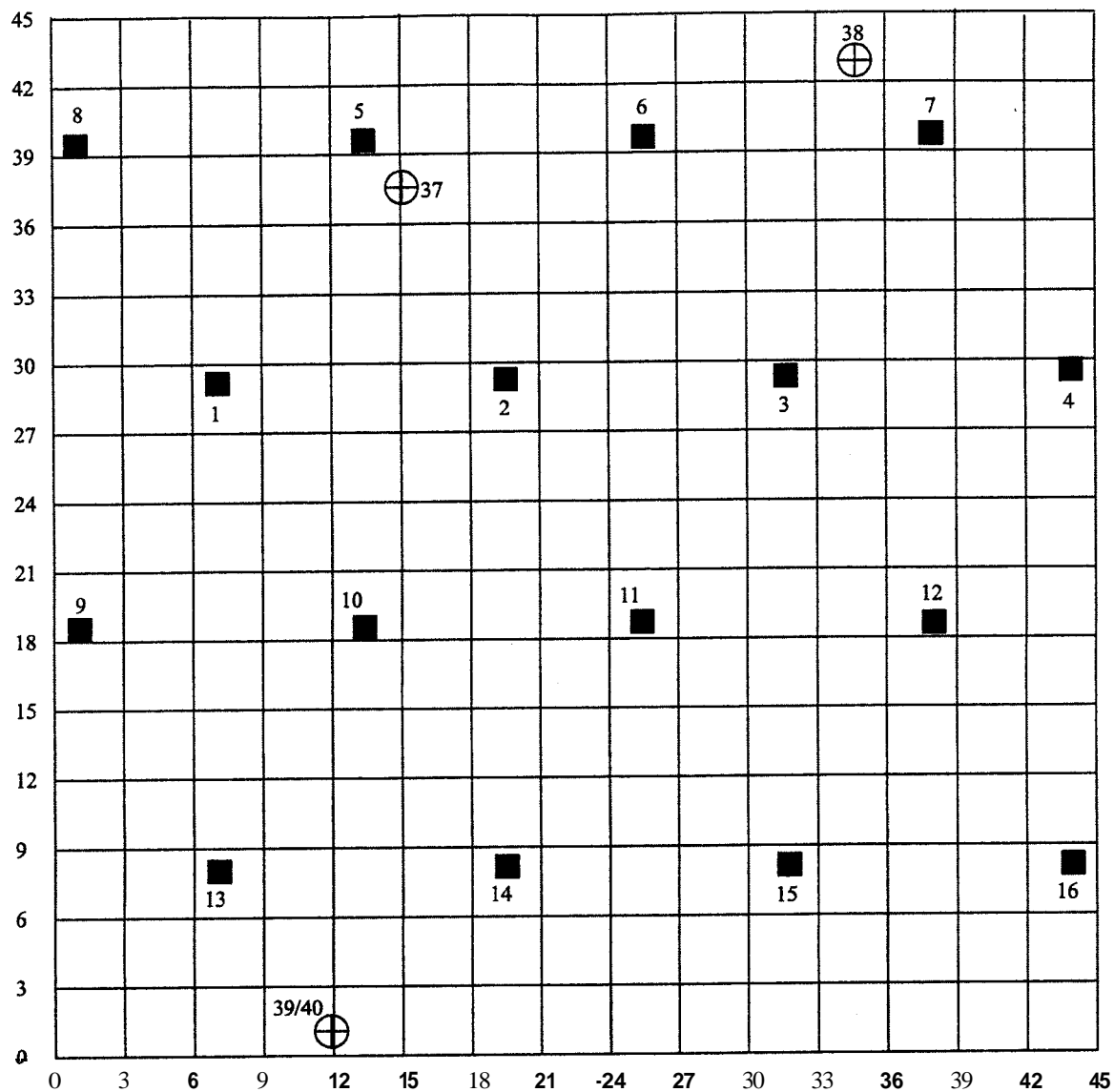


FIGURE 2: 903 Pad Area Inner and Outer lip Survey Areas



SAMPLING LOCATIONS

- # SYSTEMATIC SURFACE SOIL
- ⊕ # JUDGMENTAL SURFACE SOIL

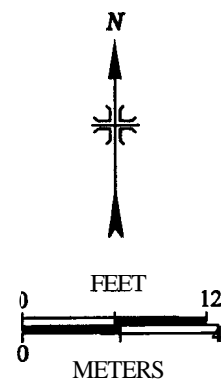
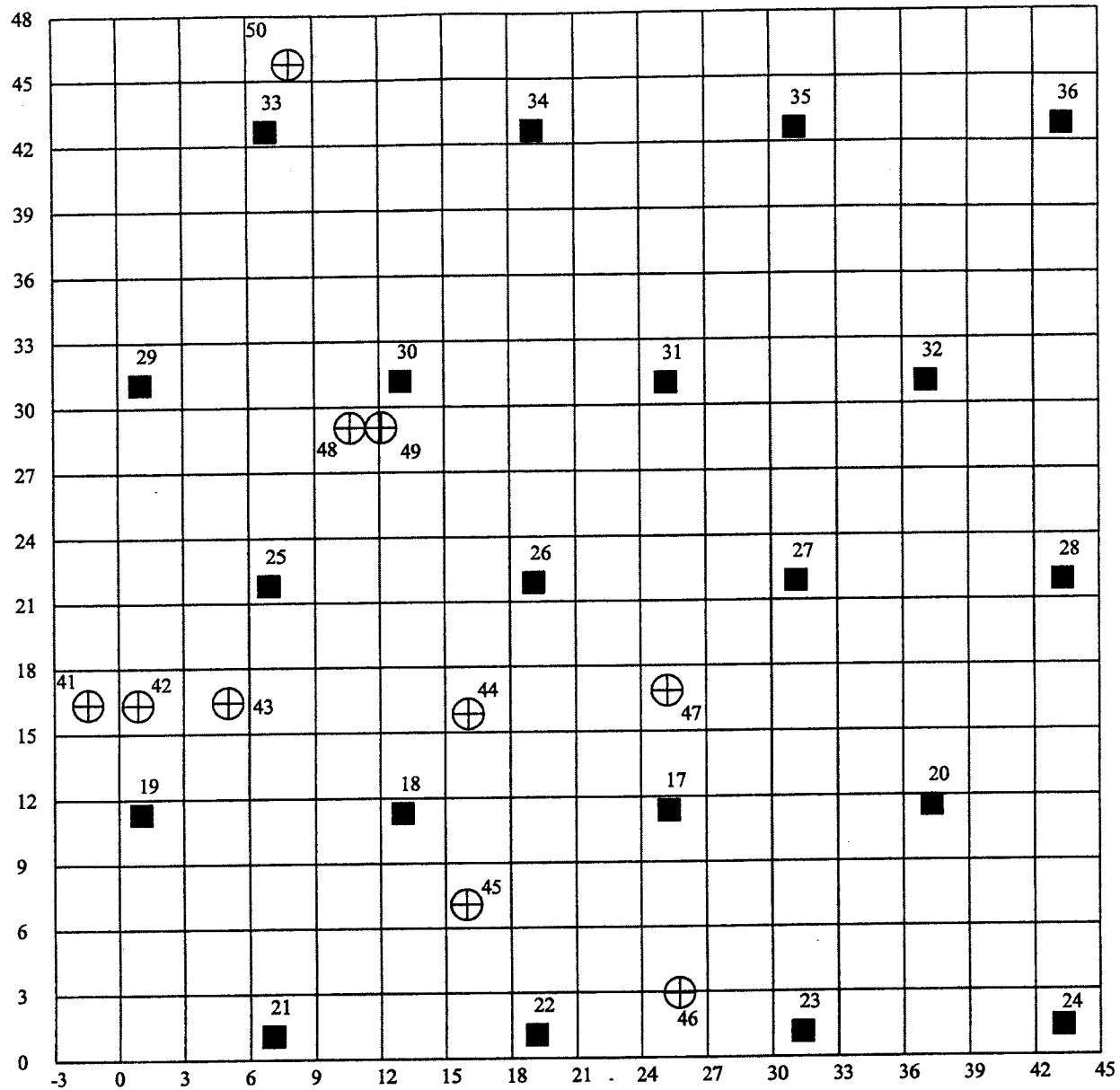


FIGURE 3: Rocky Flats Closure Site, Inner Lip Pad - Sampling Locations



SAMPLING LOCATIONS

- # SYSTEMATIC
SURFACE SOIL
- ⊕ # JUDGMENTAL
SURFACE SOIL

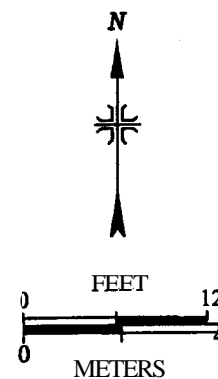


FIGURE 4: Rocky Flats Closure Site, Outer Lip Pad - Sampling Locations

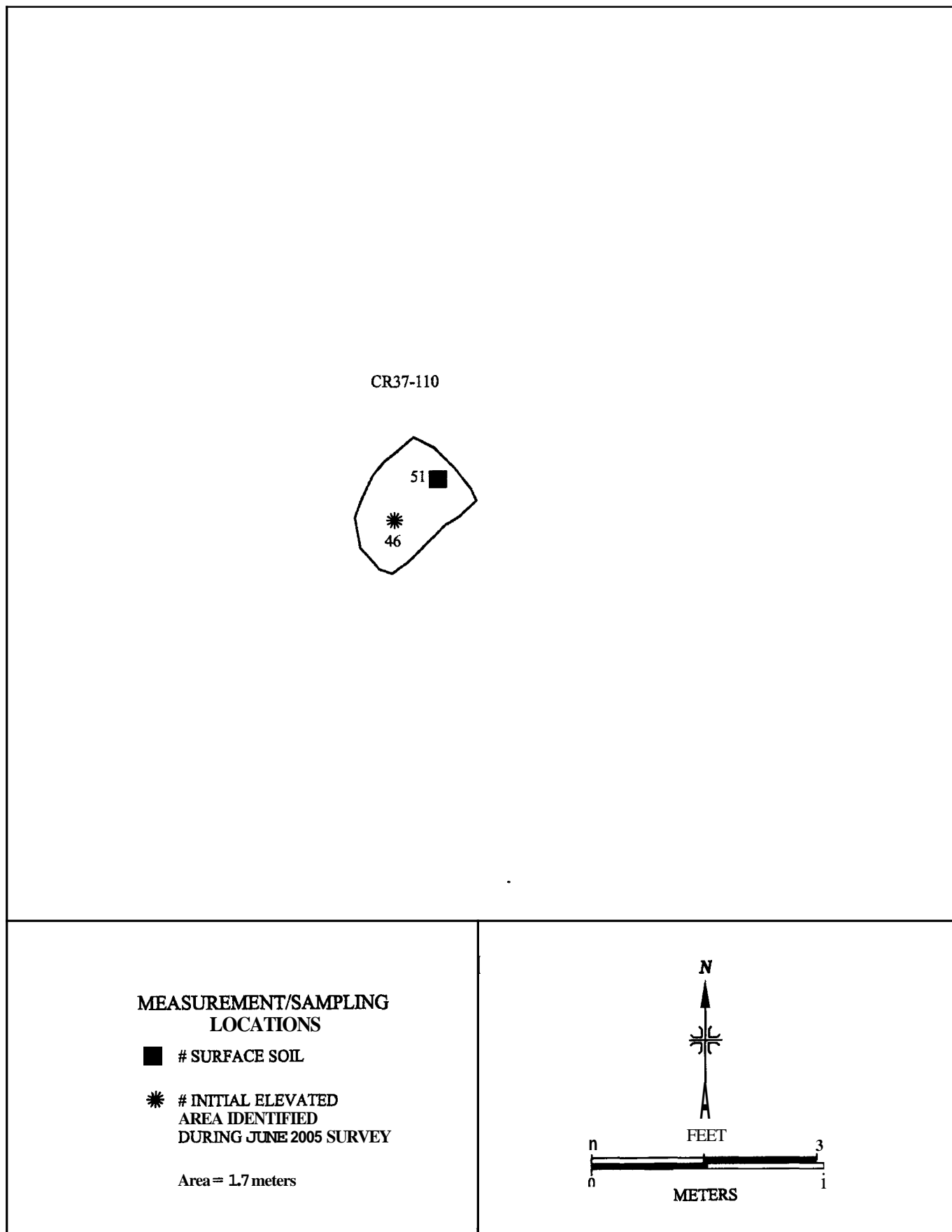
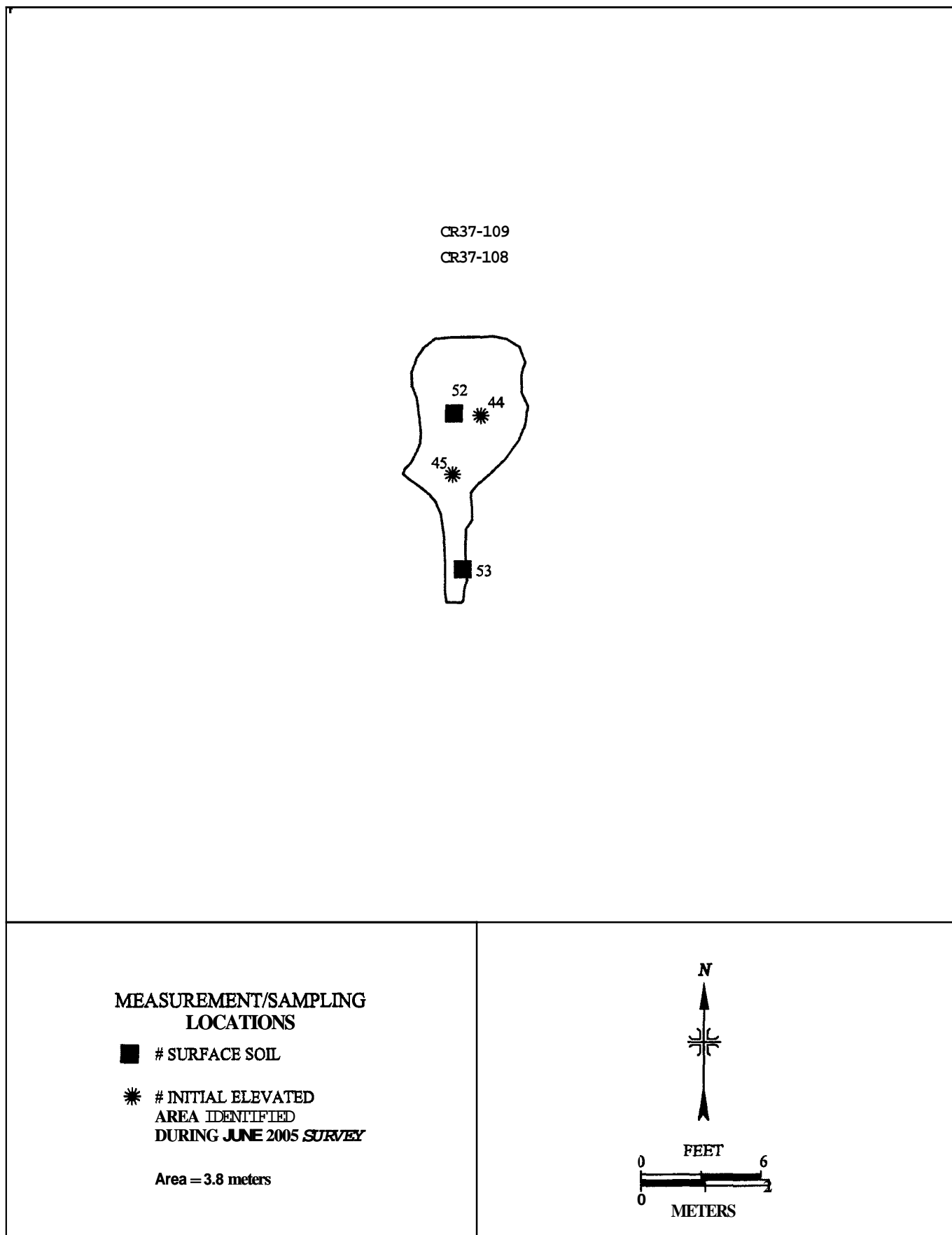
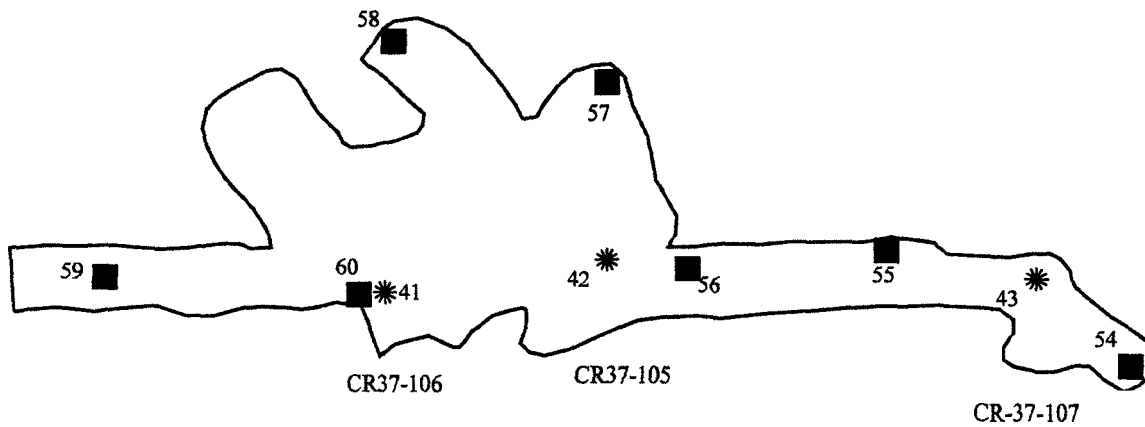


FIGURE 5: Rocky Flats Closure Site, Outer Lip Pad, Elevated Area At ORISE Sample # 46 - Measurement and Sampling Locations



**FIGURE 6: Rocky Flats Closure Site, Outer Lip Pad, Elevated Area At
ORISE Sample # 44 and 45 - Measurement and Sampling Locations**

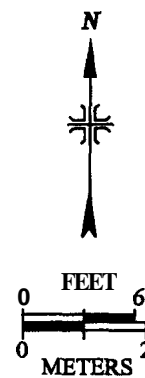


MEASUREMENT/SAMPLING LOCATIONS

■ # SURFACE SOIL

* # INITIAL ELEVATED
AREA IDENTIFIED
DURING JUNE 2005 SURVEY

Area = 35.3 meters



**FIGURE 7: Rocky Flats Closure Site, Outer Lip Pad, Elevated Area At
ORISE Samples # 41, 42 and 43 - Measurement and Sampling Locations**

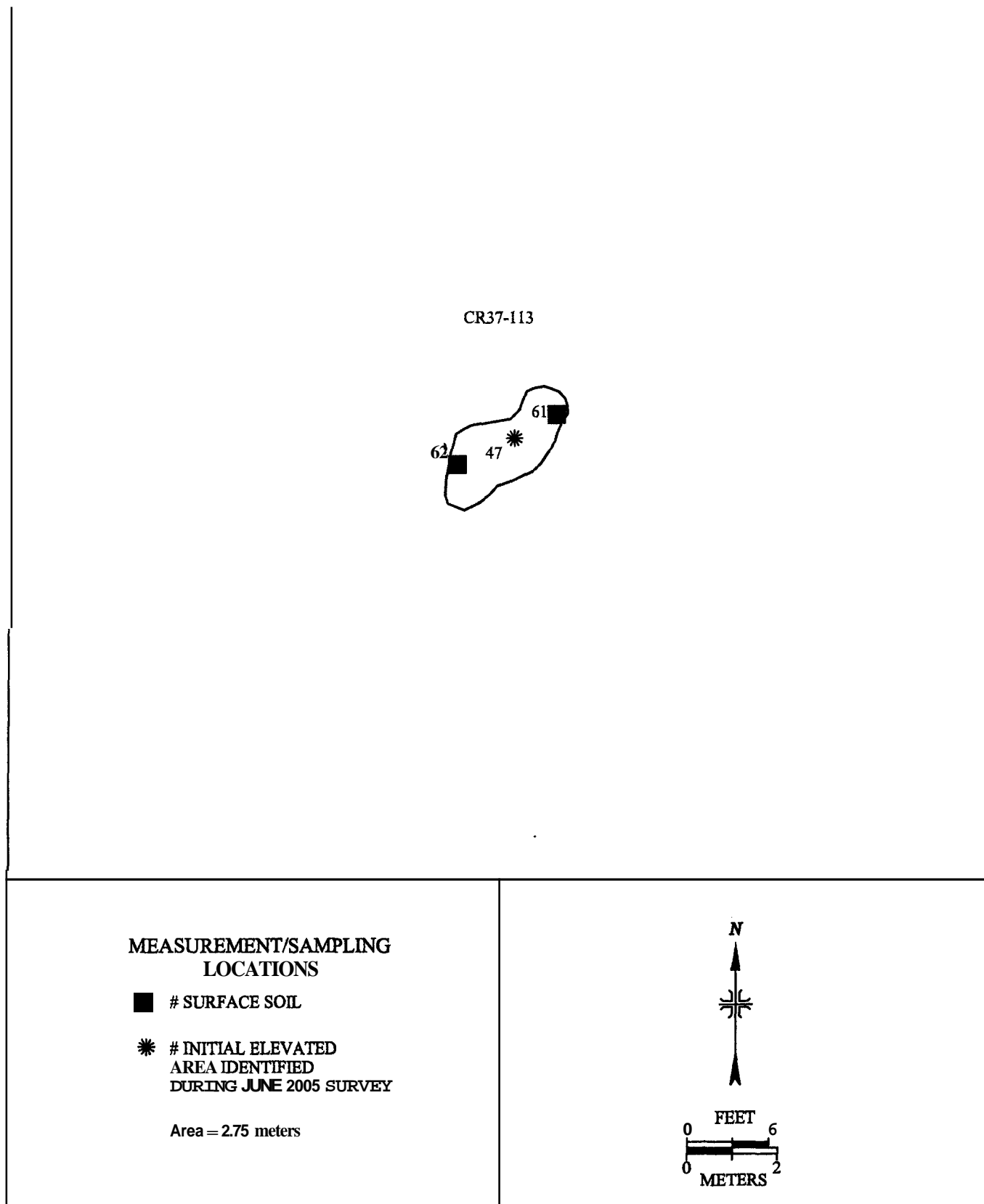


FIGURE 8: Rocky Flats Closure Site, Outer Lip Pad, Elevated Area At ORISE Sample # 47 - Measurement and Sampling Locations

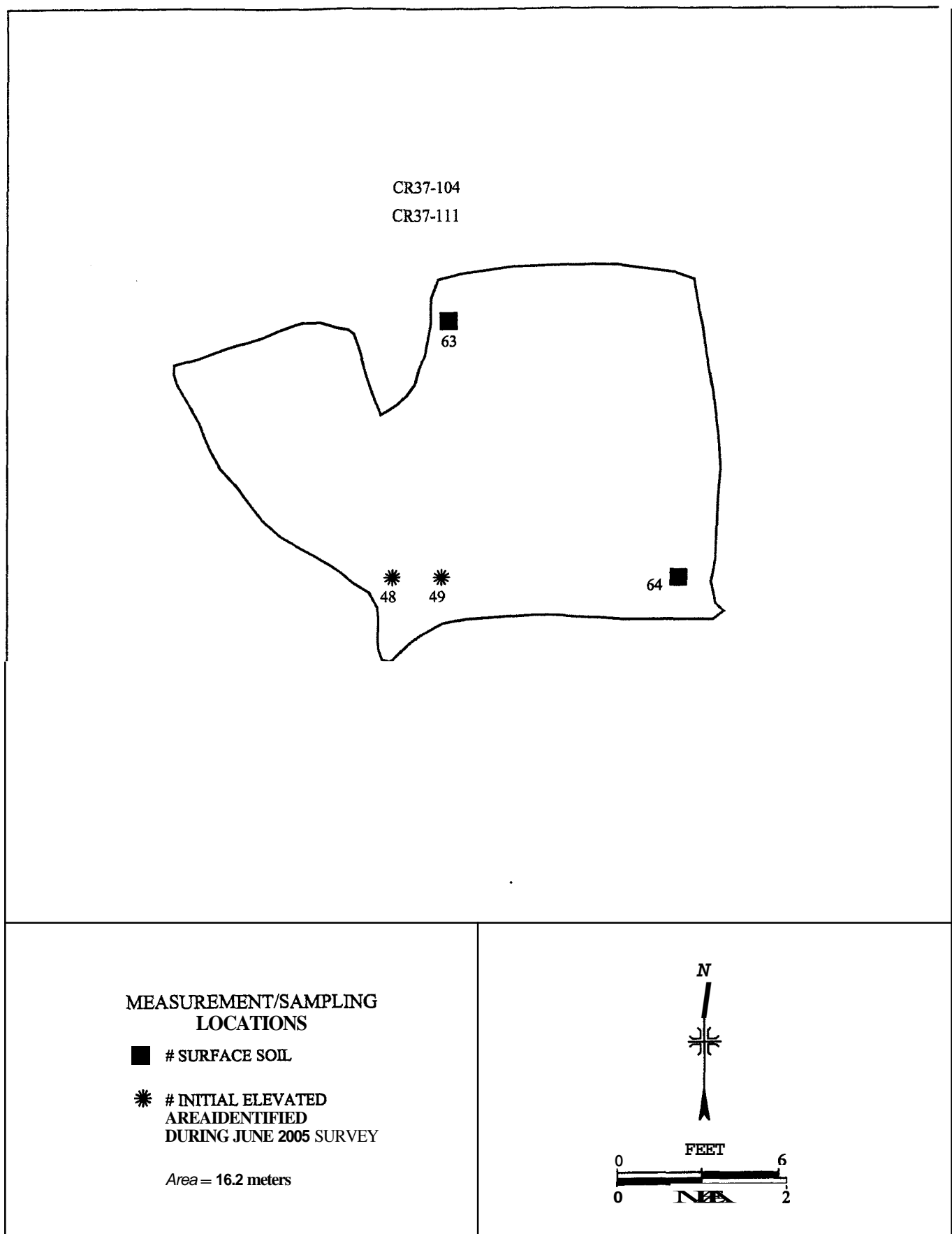


FIGURE 9: Rocky Flats Closure Site, Outer Lip Pad, Elevated Area At ORISE Samples # 48 and 49 - Measurement and Sampling Locations

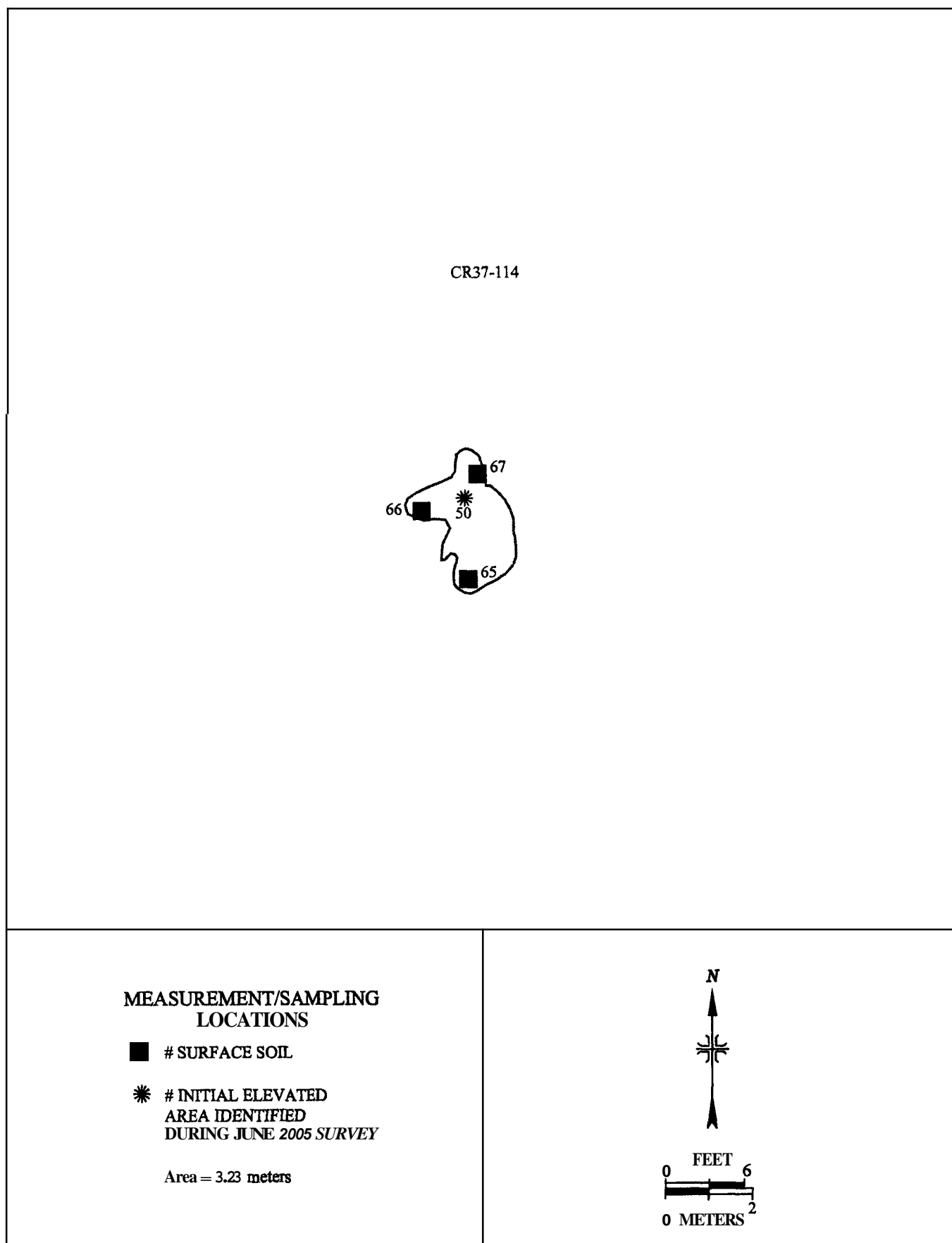
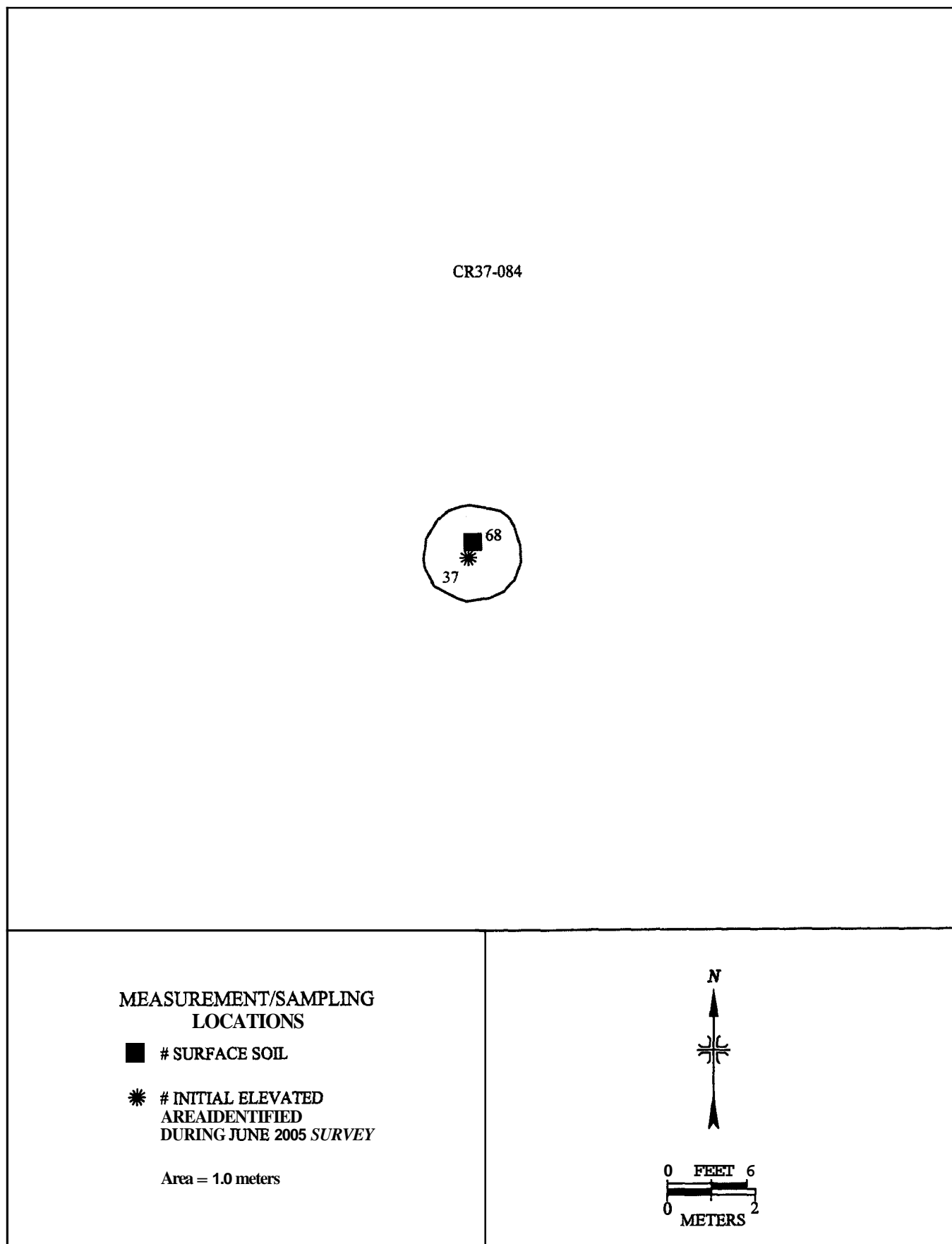


FIGURE 10: Rocky Flats Closure Site, ~~Outer~~ Lip Pad, Elevated Area At ORISE Sample # 50 - Measurement and Sampling Locations



**FIGURE 11: Rocky Flats Closure Site, Inner Lip Pad, Elevated Area At
ORISE Sample # 37 - Measurement and Sampling Locations**

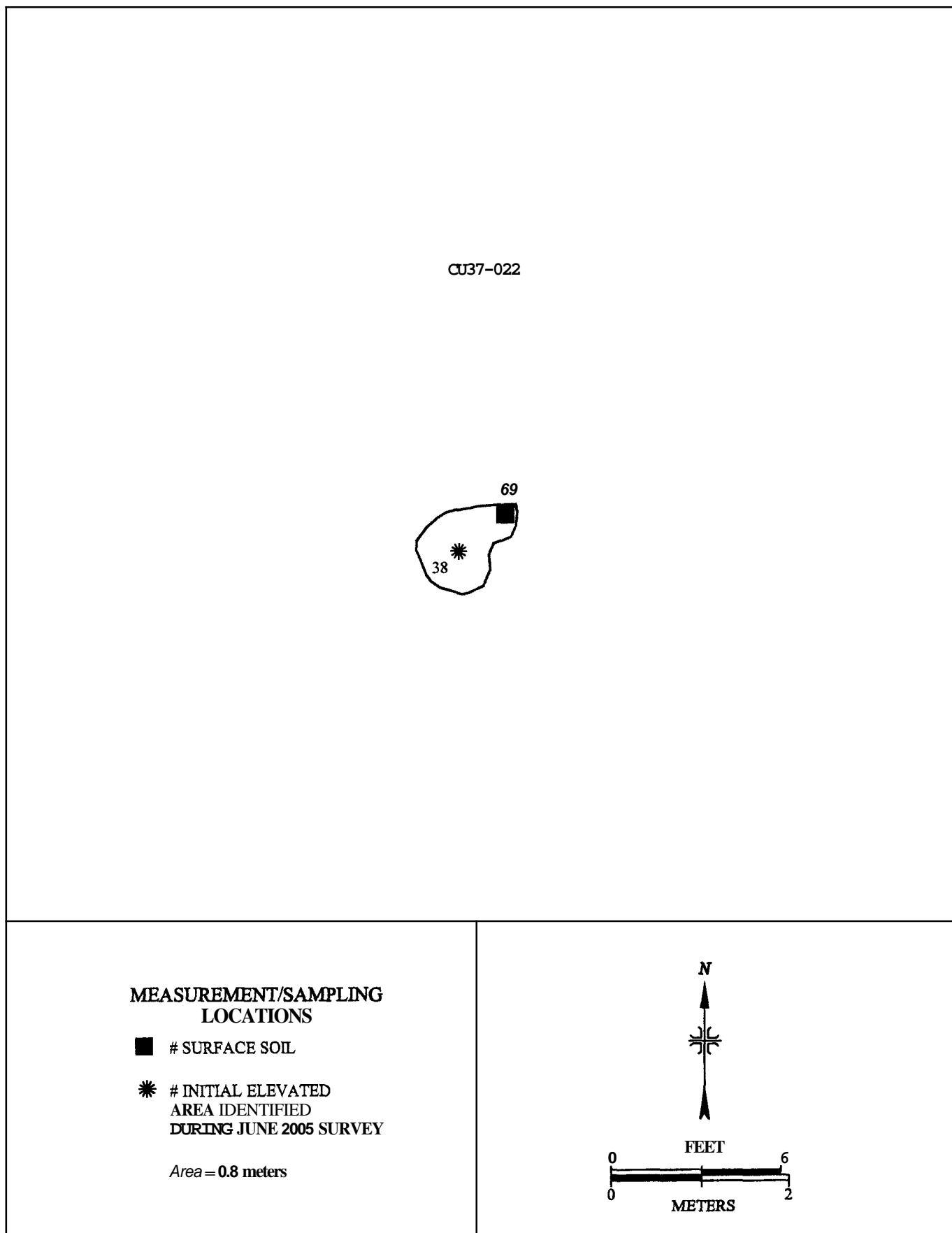
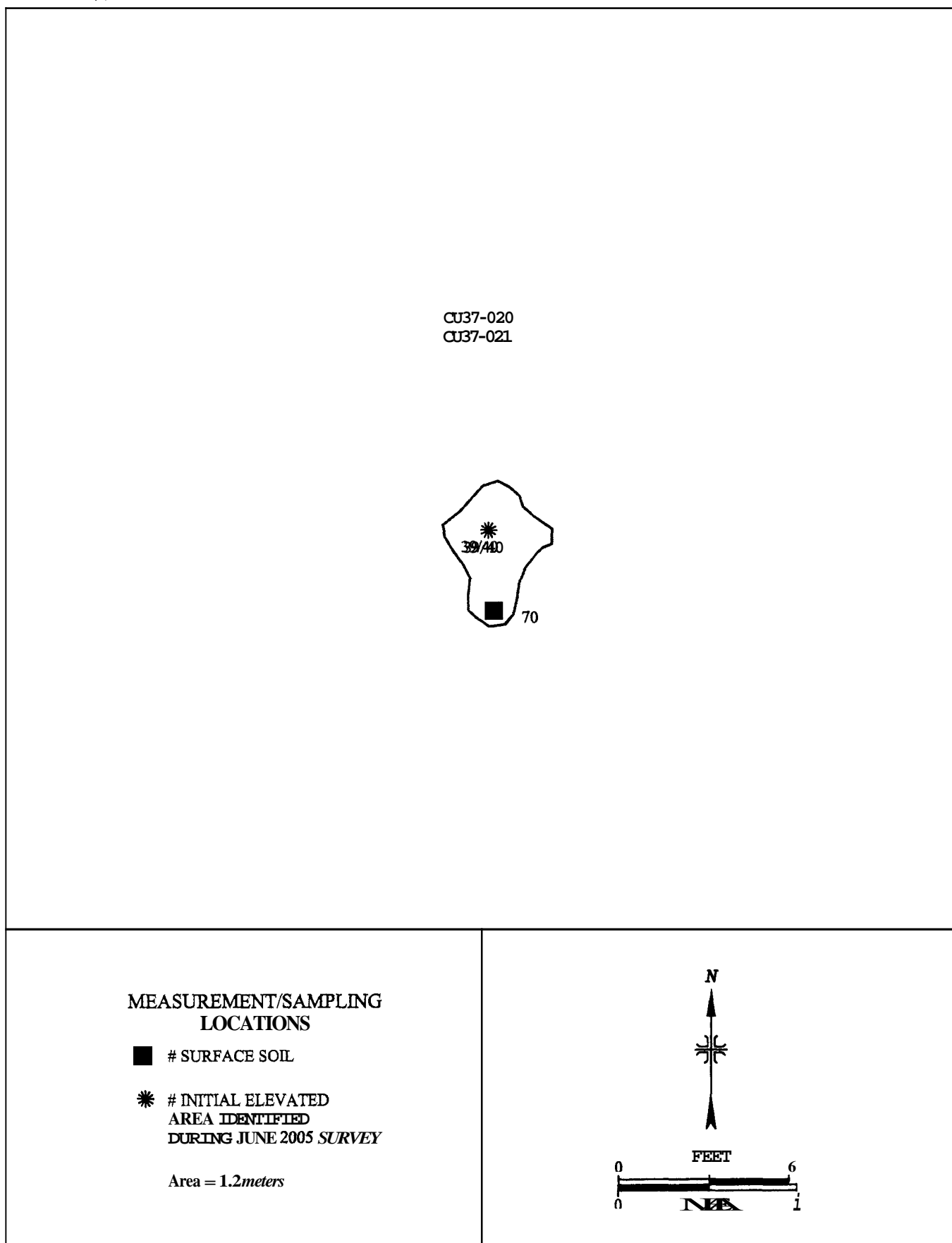


FIGURE 12: Rocky Flats Closure Site, Inner Lip Pad, Elevated Area At ORISE Sample # 38 - Measurement and Sampling Location



**FIGURE 13: Rocky Flats Closure Site, Inner Lip Pad, Elevated Area At
ORISE Samples # 39/40 - Measurement and Sampling Locations**

TABLES

TABLE 1

**RADIONUCLIDE CONCENTRATIONS IN SOIL
MARSSIM RANDOM-START SYSTEMATIC LOCATIONS
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO**

ESSAP Sample ID ^a	Location	Radionuclide Concentrations (pCi/g)	
		Am-241	Pu-239/240 ^b
903 Inner Lip Area			
1	29.13N, 7.36E	0.55 ± 0.06 ^c	3.14 ± 0.34
2	29.13N, 13.51E	5.21 ± 0.22	29.7 ±1.3
3	29.13N, 31.66E	0.62 ± 0.08	3.53 ± 0.46
4	39.65N, 13.44E	4.29 ± 0.20	24.5 ± 1.1
5	39.7N, 13.4E	1.06 ± 0.08	6.04 ± 0.46
6	39.65N, 25.59E	2.84 ± 0.14	16.20 ± 0.80
7	39.65N, 37.74E	0.22 ± 0.06	1.25 ± 0.34
8	39.65N, 1.29E	0.73 ± 0.08	4.16 ± 0.46
9	18.61N, 1.29E	0.10 ± 0.03	0.57 ± 0.17
10	18.61N, 13.44E	0.11 ± 0.05	0.63 ± 0.29
11	18.61N, 25.59E	0.20 ± 0.06	1.14 ± 0.34
12	18.61N, 37.74E	0.61 ± 0.08	3.48 ± 0.46
13	8.09N, 7.36E	0.31 ± 0.04	1.78 ± 0.23
14	8.09N, 19.51E	1.18 ± 0.07	6.73 ± 0.40
15	8.09N, 31.66E	0.84 ± 0.07	4.79 ± 0.40
16	8.09N, 43.81E	0.41 ± 0.08	2.34 ± 0.46
903 Outer Lip Area			
17	11.2N, 25.0E	0.41 ± 0.05	2.34 ± 0.29
18	11.2N, 12.85E	1.80 ± 0.10	10.26 ± 0.57
19	11.2N, 0.7E	2.87 ± 0.15	16.36 ± 0.86
20	11.2N, 37.15E	0.13 ± 0.06	0.74 ± 0.34
21	2N, 6.78E	1.70 ± 0.10	9.69 ± 0.57
22	2.3N, 18.93E	0.28 ± 0.07	1.60 ± 0.40
23	0.68N, 31.08E	0.93 ± 0.14	5.30 ± 0.80
24	0.68N, 43.73E	2.82 ± 0.17	16.07 ± 0.97
25	21.72N, 6.78E	2.69 ± 0.13	15.33 ± 0.74
26	21.72N, 18.93E	4.12 ± 0.18	23.5 ± 1.0
27	21.72N, 31.08E	7.36 ± 0.30	42.0 ± 1.7
28	21.72N, 43.23E	0.39 ± 0.09	2.22 ± 0.51
29	32.24N, 0.7E	0.22 ± 0.06	1.25 ± 0.34
30	32.24N, 12.85E	3.94 ± 0.18	22.5 ± 1.0
31	32.24N, 25E	0.86 ± 0.07	4.90 ± 0.40
32	32.24N, 37.15E	0.68 ± 0.07	3.88 ± 0.40

TABLE 1 (Continued)

**RADIONUCLIDE CONCENTRATIONS IN SOIL
MARSSIM RANDOM-START SYSTEMATIC LOCATIONS
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO**

ESSAP Sample ID ^a	Location	Radionuclide Concentrations (pCi/g)	
		Am-241	Pu-239/240 ^b
903 Outer Lip Area (Continued)			
33	42.76N, 6.78E	6.35 ± 0.25	36.2 ± 1.4
34	42.76N, 18.93E	3.24 ± 0.15	18.47 ± 0.86
35	42.76N, 31.08E	0.31 ± 0.07	1.77 ± 0.40
36	42.76N, 43.23E	0.43 ± 0.07	2.45 ± 0.40

^aRefer to Figures 3 and 4.

^bPu-239/240 concentrations calculated based on a Pu-239/240 to Am-241 ratio of 5.7 developed by the closure contractor.

^cUncertainties are total propagated uncertainties at the 95% confidence level.

TABLE 2

RADIONUCLIDE CONCENTRATIONS IN SOIL
JUDGMENTAL SAMPLE LOCATIONS
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO

ESSAP Sample ID ^a	Location	Radionuclide Concentrations (pCi/g)	
		Am-241	Pu-239/240 ^b
Inner Lip			
37	37N, 15E	74.6 ± 2.6 ^c	425 ± 15
38	43N, 35E	18.97 ± 0.71	108.1 ± 4.1
39	1N, 12E	41.8 ± 1.5	238.3 ± 8.6
40 ^d	1N, 12E	45.4 ± 1.7	258.8 ± 9.7
Outer Lip			
41	16.5N, 3W	52.8 ± 1.9	301 ± 11
42	16.5N, 0.3E	24.89 ± 0.89	141.9 ± 5.1
43	16.5N, 5.2E	13.91 ± 0.52	79.3 ± 3.0
44	16.2N, 16E	27.8 ± 1.0	158.5 ± 5.7
45	7N, 16.2E	24.91 ± 0.90	142.0 ± 5.1
46	3N, 26.5E	22.04 ± 0.81	125.6 ± 4.6
47	17N, 25E	30.2 ± 1.1	172.1 ± 6.3
48	29.5N, 11.5E	16.48 ± 0.61	93.9 ± 3.5
49	29N, 12E	21.34 ± 0.77	121.6 ± 4.4
50	45.2N, 8E	11.47 ± 0.44	65.4 ± 2.5

^aRefer to Figures 3 and 4.

^bPu-239/240 concentrations were calculated based on a Pu-239/240 to Am-241 ratio of 5.7 developed by the closure contractor.

^cUncertainties are total propagated uncertainties at the 95% confidence level.

^dSample depth 15-30 cm.

TABLE 3

**RADIONUCLIDE CONCENTRATIONS IN SOIL
PREVIOUSLY IDENTIFIED ELEVATED AREA LOCATIONS
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO**

ESSAP Sample ID ^a	Near Previous Location(s)	Radionuclide Concentrations (pCi/g)	
		Am-241	Pu-239 ^b
903 Outer Lip Area			
51	CR37-110 (ORISE 46)	24.61 ± 0.94 ^c	140.3 ± 5.4
52	CR37-108, 109 (ORISE 44, 45)	11.52 ± 0.46	65.7 ± 2.6
53	CR37-108, 109 (ORISE 44, 45)	17.98 ± 0.68	102.5 ± 3.9
54	CR37-105,106, 107 (ORISE 41,42,43)	29.5 ± 1.1	168.2 ± 6.3
55	CR37-105, 106, 107 (ORISE 41, 42, 43)	17.65 ± 0.66	100.6 ± 3.8
56	CR37-105, 106,107 (ORISE 41, 42, 43)	10.14 ± 0.38	57.8 ± 2.2
57	CR37-105, 106, 107 (ORISE 41, 42, 43)	10.20 ± 0.41	58.1 ± 2.3
58	CR37-105, 106, 107 (ORISE 41, 42, 43)	8.85 ± 0.35	50.5 ± 2.0
59	CR37-105, 106, 107 (ORISE 41, 42, 43)	16.75 ± 0.61	95.5 ± 3.5
60	CR37-105, 106, 107 (ORISE 41, 42, 43)	8.68 ± 0.35	49.5 ± 2.0
61	CR37-113 (ORISE 47)	18.87 ± 0.73	107.6 ± 4.2
62	CR37-113 (ORISE 47)	22.03 ± 0.80	125.6 ± 4.6
63	CR37-104, 111 (ORISE 48, 49)	21.01 ± 0.77	119.8 ± 4.4
64	CR37-104, 111 (ORISE 48,49)	26.06 ± 0.98	148.5 ± 5.6
65	CR37-114 (ORISE 50)	13.00 ± 0.51	74.1 ± 2.9
66	CR37-114 (ORISE 50)	9.96 ± 0.40	56.8 ± 2.3
67	CR37-114 (ORISE 50)	22.82 ± 0.90	130.1 ± 5.1
903 Inner Lip Area			
68	CR37-084 (ORISE 37)	1.25 ± 0.10	7.13 ± 0.57
69	CU37-022 (ORISE 38)	51.8 ± 1.8	295.3 ± 10.3
70	CU37-020,021 (ORISE 39, 40)	44.5 ± 1.6	253.65 ± 9.12

^aRefer to Figures 5 through 13.

^bPu-239 concentrations calculated based on a Pu-239 to **Am-241** ratio of 5.7 developed by the closure contractor.

^cUncertainties are total propagated uncertainties at the 95% confidence level.

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